

What is claimed is:

1. An embolic material comprising a flowable, settable material, and a plurality of coated magnetically responsive particles disposed therein, the particles comprising cores of a magnetically responsive material between about 2 nm and about 20 nm in diameter, and a non-magnetically responsive layer around the core sufficient thickly to give the particles a diameter of between about 20 nm and about 40 nm.

2. The embolic material according to claim 1 wherein the cores of the particles have a diameter between about 7 nm and about 15 nm

3. The embolic material according to claim 2 wherein the layer is sufficiently thick to give the particles a diameter between about 25 nm and about 35 nm.

4. The embolic material according to claim 1 wherein the layer is sufficiently thick to give the particles a diameter between about 25 nm and about 35 nm.

5. The embolic material according to claim 1 wherein the magnetically responsive cores comprise iron or an iron compound.

6. The embolic material according to claim 5 wherein the magnetically responsive cores comprise magnetite (Fe_3O_4).

7. The embolic material according to claim 5 wherein the magnetically responsive cores comprise hematite (Fe_2O_3).

8. The embolic material according to claim 1 wherein the magnetically responsive cores include a radiopaque material.

9. The embolic material according to claim 1 wherein the non-magnetically responsive layer comprises a polymer backbone wherein each repeat unit of the polymer

backbone is bonded to a long chain polymer and an anchor group, creating a plurality of long chain polymers and anchor groups on the polymer backbone.

10. The embolic material according to claim 9 wherein the polymer chains comprise poly(propylene glycol).

11. The embolic material according to claim 10 wherein the polymer chains include a carboxyl group anchoring the chains to the core.

12. The embolic material according to claim 9 wherein the polymer chains include a carboxyl group anchoring the chains to the core.

13. The embolic material according to claim 1 wherein the non-magnetically response layer comprises a polymer backbone with long chain polymers bonded to polymer repeat units and anchor groups bonded to different repeat units, creating a plurality of long chain polymers and anchor groups on the polymer backbone.

14. The embolic material according to claim 13 wherein the polymer chains comprise poly(propylene glycol).

15. The embolic material according to claim 13 wherein the backbones comprise carboxyl groups anchoring the backbones to the cores.

16. The embolic material according to claim 13 further comprising radiopaque moieties on the backbones.

17. The embolic material according to claim 1 wherein magnetically responsive material comprises less than or equal to about 5% by volume of the embolic material.

18. The embolic material according to claim 1 further comprising radiopaque particles.

19. The embolic material according to claim 18 wherein the radiopaque particles comprise gold cores of between about 7 and about 15 nm in diameter.

20. The embolic material according to claim 19 wherein the radiopaque particles comprise a non-magnetically responsive layer around the gold cores.

21. The embolic material according to claim 20 wherein the non-magnetically responsive layer comprises a plurality of polymer chains anchored to the cores.

22. The embolic material according to claim 21 wherein the polymer chains comprise poly(propylene glycol).

23. The embolic material according to claim 22 wherein the polymer chains include a thiol group anchoring the chains to the gold cores.

24. The embolic material according to claim 1 wherein the polymer chains are hydrophobic.

25. An embolic material comprising a polymerizable hydrophobic suspension of coated magnetically responsive particles (e.g. magnetite Fe_3O_4) suspended in a solvent monomer, a bulking agent, a radiopaque monomer, and an accelerant, and an initiator.

26. An embolic material comprising a mixture of (a) a polymerizable hydrophobic suspension of coated magnetically responsive particles (e.g. magnetite Fe_3O_4) suspended in a solvent monomer, a bulking agent, a radiopaque monomer, and an accelerant, and (b) a monomer and an initiator.

27. An embolic material comprising coated magnetically responsive particles, a monomer, a radiopaque monomer, a three-dimensional cross-linker; an accelerant; and an initiator.

28. An embolic material comprising coated magnetically responsive particles, a methyl methacrylate monomer, 1-(2,3,5 triiodobenzoyloxy)-2-(methacroyloxy)ethane radiopaque monomer, Trimethylolpropane ethoxylate (14/3 EO/OH) three dimensional cross-linker, poly(methylmethacrylate) bulking agent; N,N dimethyl toluidine (DMT) accelerant; and lauryl peroxide (LPO) initiator.

29. An embolic material formed from mixing two parts, part I comprising coated magnetically responsive particles, a monomer, a radiopaque monomer, a three-dimensional cross-linker, a bulking agent, and an accelerant; and part II comprising a monomer and an initiator.

30. An embolic material formed from mixing two parts, part I comprising coated magnetically responsive particles, methyl methacrylate monomer, 1-(2,3,5 triiodobenzoyloxy)-2-(methacroyloxy)ethane radiopaque monomer, Trimethylolpropane ethoxylate (14/3 EO/OH) three dimensional cross linker, poly(methylmethacrylate) bulking agent; and N,N dimethyl toluidine (DMT) accelerant, and part II comprising methyl methacrylate monomer and lauryl peroxide (LPO) initiator.

31. The embolic according to claim 30, wherein part I comprises 1 g methyl methacrylate monomer; 0.5 g 1-(2,3,5 triiodobenzoyloxy)-2-(methacroyloxy)ethane radiopaque monomer; 0.2 g Trimethylolpropane ethoxylate (14/3 EO/OH)), 1 g poly(methylmethacrylate) bulking agent; 0.02 g N,N dimethyl toluidine (DMT) accelerant); and 1.4 grams of the coated magnetic particles; and Part II preferably comprises a 3.31 g methyl methacrylate monomer; and 0.52 g lauryl peroxide (LPO) initiator.

32. The embolic according to claim 31 wherein part I and part II are mixed in a volume ratio of about 5:1.

33. The embolic according to claim 30 wherein the coated magnetically responsive particles have an average diameter of between about 25 and about 35 nm.

34. The embolic according to claim 33 wherein the coated magnetically responsive particles have a magnetically responsive core with an average diameter of between about 5 and about 15 nm.

35. The embolic according to claim 34 wherein the coated magnetically responsive particles have an average diameter of about 30 nm, and magnetically responsive cores having an average diameter of about 10 nm.

36. A magnetically responsive embolic containing coated magnetic particles for which the magnetic core average diameter is between 5 and 15 nm and the coating thickness buffers the magnetic interactions so that the presence of an externally applied magnetic field will not cause a substantial departure of the embolic from a uniform mixture of its constituents.

37. The embolic of claim 36 in which the embolic is sufficiently self coherent that it will not separate in or at the surface of an aneurysm when the blood is flowing past at a velocity up to 80 cm/sec.

38. The embolic of claim 37 in which the magnetic core average diameter is between 5 and 30 nm diameter.

39. The embolic of claim 38 in which the embolic is sufficiently self coherent that it will not separate in or at the surface of an aneurysm when the blood is flowing past as a velocity up to 150 cm/sec.